

IPP Petroleum Coke Test Burn

Phase 1 Preliminary Results Discussion

The purpose of Phase 1 is to conduct a preliminary feasibility test of:
1) blending, 2) handling and 3) combustion characteristics of petroleum coke.

Blending

- Modified 7D rotary plow feeder. (Removed 3 of 6 arms and shortened the remaining 3 arms)
- At minimum on variable speed drive reclaimed ~130 TPH
- Coal Handling did an excellent job of delivering the requested blend to the unit
- Blend loaded into mill silos began to appear sooner than expected and took longer to achieve full blend impact
- Once remaining coke supply near 2500 to 3000 tons it is more difficult to control blend accurately
- Conclusion: No obstacles encountered

Handling

- Petroleum coke was not frozen in cars on arrival
- Railcars unloaded without incident
- No difference in dusting or other related factors noted
- Although some of the coke is spherical, no difficulty in keeping material on inclined conveyors
- No bridging in hoppers noted
- Conclusion: During this test no undesirable handling issues were identified

Combustion Characteristics

- Flame appearance unchanged, flames attached to burners and stable
- Flame scanner function not impaired (Note: On 12/6 "C" mill tripped due to "B group" scanner failure. I&C replaced mirror, adjusted scanner and mill returned to service.)
- No difficulty bringing Unit 1 back on line after trip with 20% blend in mill silos
- Total fuel flow to unit reduced as coke introduced due to higher heating value of the coke
- Conflicting data relative to changes in NO_x emissions while firing coke, further evaluation required
- Operationally NO_x can be controlled below regulatory limit of 0.5 #NO_x/MMBtu, (Note: A few incidences where NO_x emissions briefly exceeded regulatory limits were reported. These events are believed to be associated with mechanical and/or electrical problems with the mills.)
- Conclusion: To date there are no combustion related problems which would prevent the successful utilization of at least a 20% coke blend

Phase 1 has not yet been completed and the data taken so far has not been completely reviewed. However, results so far indicate that per the Phase 1 evaluation criteria, the test is a success. No obstacles related to blending, handling, or actual combustion of up to 20% petroleum coke have been observed.

IPP Phase 1 Issues

Pulverizer Upsets on Unit 1 While Burning a Pet-Coke Blend

Unrelated Upsets

1. U1 tripped off-line on 12/3, while firing coke. Cause: turbine lube oil pressure trip during system test
2. During U1 startup, "C" mill tripped. Cause: ignitors would not insert
3. "B" mill could not be put in service from 12/4-5. Cause: bad DSC controller board and current converter
4. "C" mill tripped due to loss of "B group" scanner. Cause: scanner needed a new mirror and to be adjusted
5. Shutdown "C" mill to see effects of coke burning; inspected mill, feeder and coal pipes. Conclusion: no problems found
6. "D" mill taken out of service. Cause: maintenance request for 3000 hour inspection

Undetermined Upsets

1. Pluggage in "H" mill lower bowl pyrite rejection chute. Action: Not seeing rejects so chute cleared
2. Fire detected in "C" mill lower bowl rejection chute. Fire extinguished and chute cleared
3. Fire detected in "F" mill lower bowl rejection chute. Noticed yellow smoke, a flash and oily deposit on pyrites hopper door. Action: fire extinguished and chute cleared (Note: During this period Unit 2 also experienced a pulverizer fire.)
4. "F" mill was overloaded and caused a boiler pressure excursion. Action: Operator put feeder in manual, reestablished control and put unit back in AGC.

Overall Conclusion: Some mill upsets may be linked to the pet-coke blend. However, the undetermined pluggages and fires were not significantly different than fires experienced on coal only operation. Further evaluation as planned in Phase 2 is recommended.

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Other Miscellaneous Issues (Some Outside Phase 1 Scope)

SO2 Scrubbing

- Scrubber Performance
- Regulatory Compliance
- Sodium Formate Consumption
- Thickener Operation and Sludge Handling

Boiler Operation

- Generation
- Slagging/Fouling
- Heat Rate/Efficiency

Flyash Quality

- Color Darker
- LOI Increased from Roughly 0.55 to 1.65
- Marketability with Pet-Coke

Undocumented Observations

- Sulfur Odor in Pulverizer Area
- Reported Incident of High CO in Baghouse

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PETROLEUM COKE

The responses are from a search of the Internet (Lycos) under Petroleum Coke. One of the "Hits" came from Great Lakes Carbon Corporation at <http://www.glc carbon.com/index.htm>. Mr. Bob Dickie of GLCC provided the following information. Petroleum coke is widely used in the utility industry (throughout the US and the world). Some plants burn 100% petcoke and others burn blends with coal. It is estimated more than 20 million tons are burned yearly in utility boilers. The handling characteristics of petroleum coke are very similar to coal.

There are 5 different types of petroleum coke or fuel coke:

Sponge coke;

Needle coke;

Shot coke (the hardest, most dense of the types);

Fluid coke; and

Flex coke.

The sponge coke is the most commonly used type for utility boilers. This has a higher BTU content per unit mass than most coals but is less dense. In general, petroleum coke is softer than coal (especially bituminous) and easier to crush. Petroleum coke also has a higher moisture content so it is actually less prone to dusting than coal (especially the Western, low sulfur types). The explosiveness of the petroleum coke is no worse (and probably not as bad as western low sulfur coal). At this time, there are distinct advantages to burning fuel coke. Among these are the low ash content and the current market price is very low. Mr. Dickie can be reached at riden@ho.glc carbon.com.

Other information can be found at:

<http://www.newswest.com/svherald/daily/97/mar/19/A3petroleumcoke.html>

Anacortes eases petroleum coke hauling problems; <http://www.roskill.co.uk/petcoke.html>

Petroleum Coke - World Market Overview from

Roskill; [http://www-mpl.sri.com/h\[projects\]pic2027.html](http://www-mpl.sri.com/h[projects]pic2027.html)

Economic and Environmental Feasibility of Petroleum Coke-Fired Power Generation;

<http://mccoy.lib.siu.edu/projects/crelling2/atlas/PetroleumCoke/pettut.html>

Petroleum Coke Tutorial